

# Features

# Contributions

# A pplications and custom designs

Safe	<p>A.Low pressure</p> <ul style="list-style-type: none"> <li>•&lt;10 bar at discharge</li> <li>• In case of leakage, sudden temperature drop will dramatically decrease hydrogen flow rate</li> </ul> <p>b.Solid state storage</p> <ul style="list-style-type: none"> <li>•Hydrogen chemically bonded in alloy in solid phase, even gunshot will not result explosion</li> </ul> <p>c.SS316L stainless steel structured shell</p> <ul style="list-style-type: none"> <li>•Higher heat transfer</li> <li>•No alloy subsiding effects</li> <li>•Extra-strong shell</li> </ul>
Reliable & Practical	<p>a.Operates at ambient temperatures:</p> <ul style="list-style-type: none"> <li>•No additional heating/cooling required</li> </ul> <p>b.Multi layer, specially designed internal structure:</p> <ul style="list-style-type: none"> <li>•No alloy powder detectable at discharge</li> </ul> <p>c.Standard size valves and connects</p> <ul style="list-style-type: none"> <li>•Assembled with connects by Swagelok, Parker, Misumi...</li> </ul> <p>d.Small size, portable design</p> <ul style="list-style-type: none"> <li>•For high pressure vessels, same volumetric density can be achieved under at least 600 bar pressure</li> </ul> <p>e.Modular assembly:</p> <ul style="list-style-type: none"> <li>•With large spectrum of standard canisters, any large capacity and/or flow rate can be achieved</li> </ul>
Economical	<p>a.Long life cycle:</p> <ul style="list-style-type: none"> <li>•Rechargeable more than 3000 cycles with &lt;10% decay in hydrogen absorption capability</li> <li>•Easy break-even with the original price</li> </ul> <p>b.Low pressure:</p> <ul style="list-style-type: none"> <li>•Totally eliminates gas compressor use</li> <li>•Complying with international safety regulations</li> <li>•Saves largely on specialist staff, safety equipment costs</li> </ul> <p>c.High purity:</p> <ul style="list-style-type: none"> <li>• Charged with only 99.99% hydrogen, automatic delivery of 99.9999% hydrogen is achieved at 10 times lower gas cost</li> </ul>

Global climate change is happening **today**. At this rate, what awaits us **tomorrow** is a mystery. Intensive researches on clean and efficient technologies are being done all around the world, but they are promising results of **tomorrow**. World is in dire need of prominent solutions **today**, yet no system is guaranteeing any economy and/or safety for **today**'s use.

H Bank Technology Inc. has developed standard products for research markets that can be easily integrated and safely commercialized to solve the **today's** problems. Through close collaborations with fuel cell system designers, we are looking forward serving the world with the safest and the most practical commercialized hydrogen power source ever developed::

# Contact us today!

**H Bank Technology Inc.**  
No. 3, Alley 403, Sec 6, Zhongxiao E. Rd.,  
Nangang District, Taipei City 115, Taiwan R.O.C  
Tel: +886-2-2653-3300 Fax: +886-2-2785-7640  
E-mail:service@hbank.com.tw  
<http://www.hbank.com.tw>

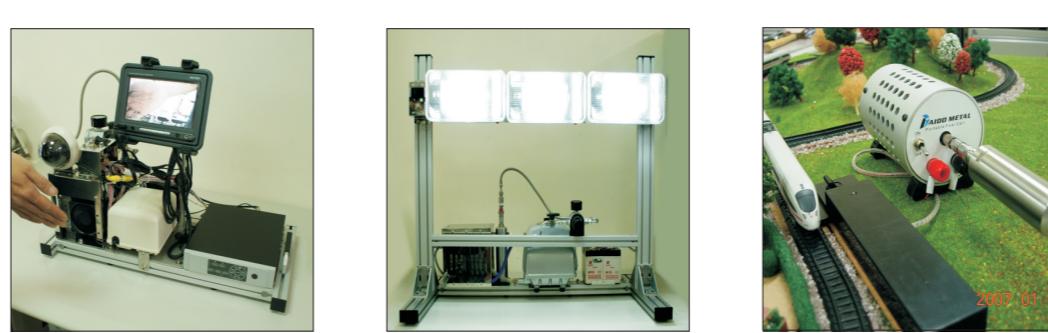
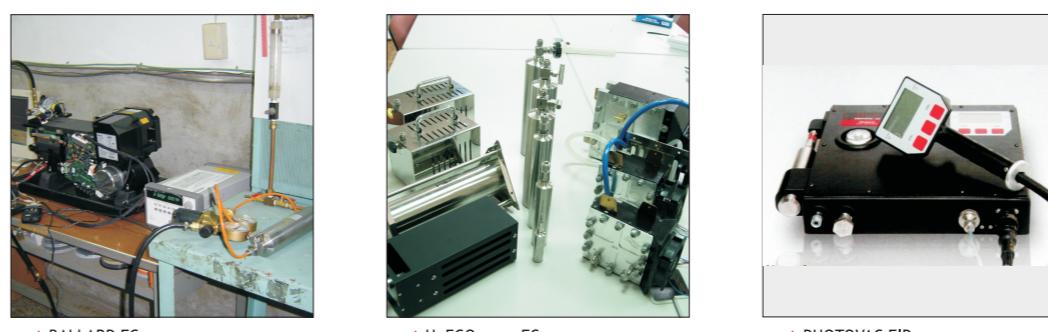
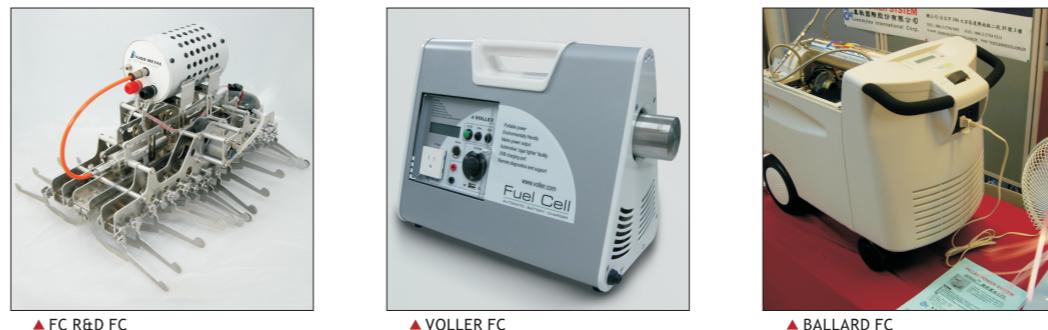
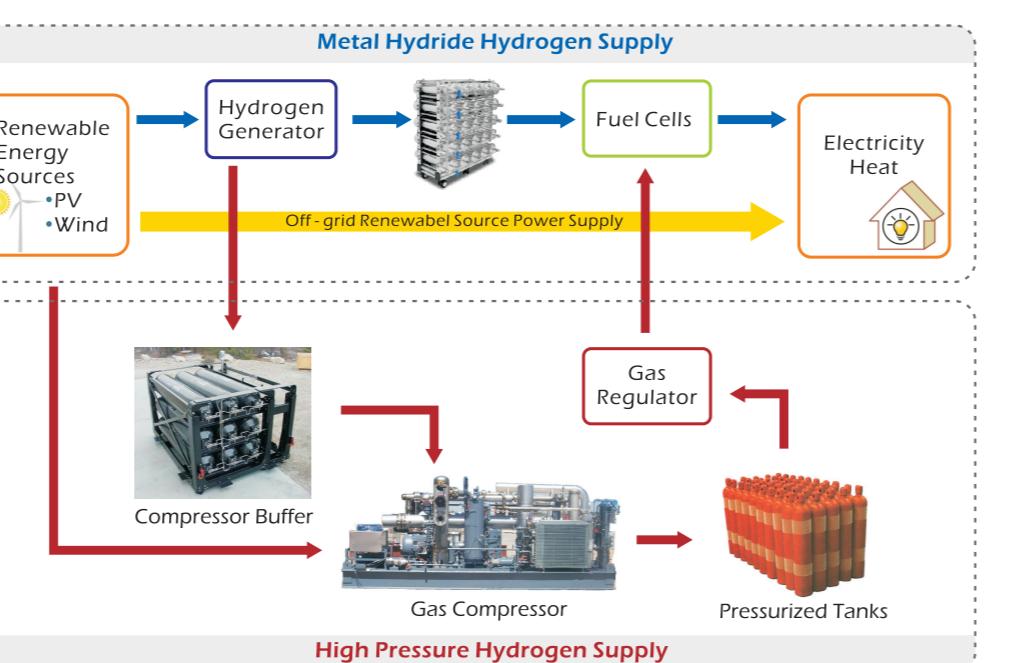


At H Bank Technology Inc., we always strive for a better future of efficient energy equipments. Our R&D team regularly collaborates with domestic and foreign research institutions on environmentally friendly power systems. We are very proud of our collaboration with Taiwan's power company – Taipower Research Institute and Industrial Technology Research Institute of Taiwan in 2006. The project marked the world's first off-grid power plant that runs 100% on renewable energy sources. The idea was to utilize surplus energy from renewable energy sources (sun/wind) to produce hydrogen on-site, store hydrogen in a legal, secure system and run fuel cell whenever primary energy sources are unavailable. The system has been running since the first set up.

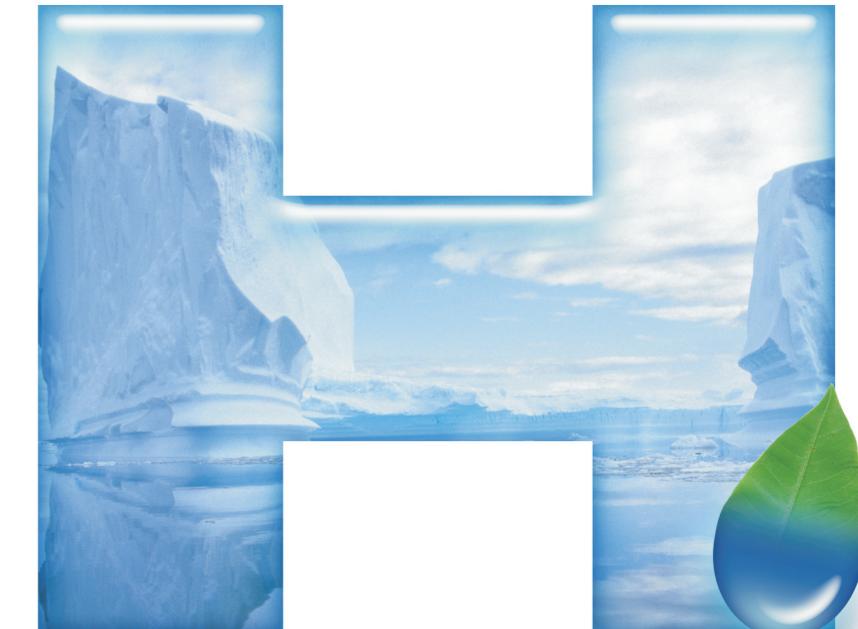
chipower Renewable Energy System



The project implementers considered using high pressure vessels at first, but according to Taiwan R.O.C safety regulations, 10bar is the limit for pressure vessels in public spaces. Moreover, hydrogen compression requires multi-step, cost ineffective, bulky system. H Bank Technology Inc.'s metal hydride hydrogen storage not only enabled the project to be carried out as a public facility, but omitted complex, highly dangerous equipment list of high pressure hydrogen storage.

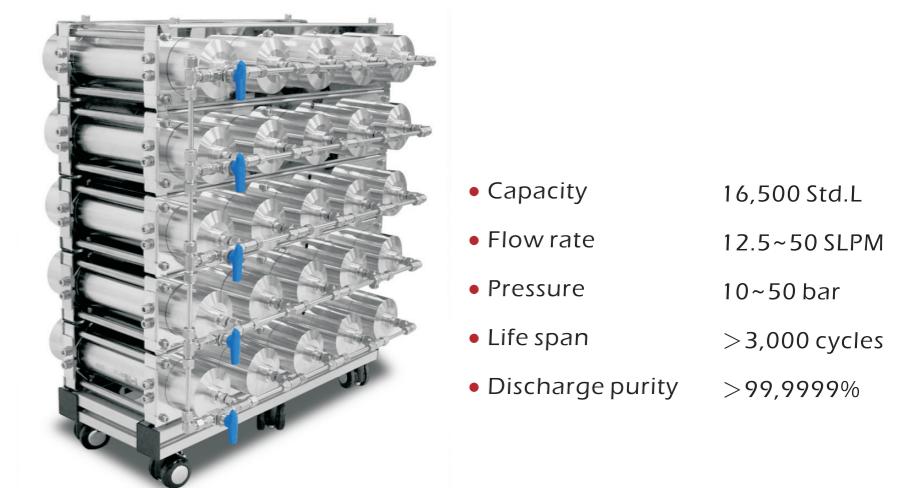


# Empowering Fuel Cells



- *Safe*
- *Scalable*
- *Rechargeable*

# Metal Hydride Hydrogen Storage



# A bout us

Today's technology for  
Today's problems



## Introduction:

H Bank Technology Inc. is a manufacturer of **Metal Hydride** hydrogen storage systems. With more than 30 years of research background on the field, our core-technology team has successfully commercialized metal hydride technology to meet rigorous hydrogen storage demands of highly specialized markets, such as: **industrial analytical instruments**, **hydrogen fuel cells** and **energy saving hydrogen mixed fuel burners**.

H Bank Technology Inc.'s metal hydride hydrogen storage systems, easily integrated with hydrogen instruments of world renowned manufacturers specializing in energy saving applications, have been proven de facto the safest, most reliable commercial hydrogen storages on the market.

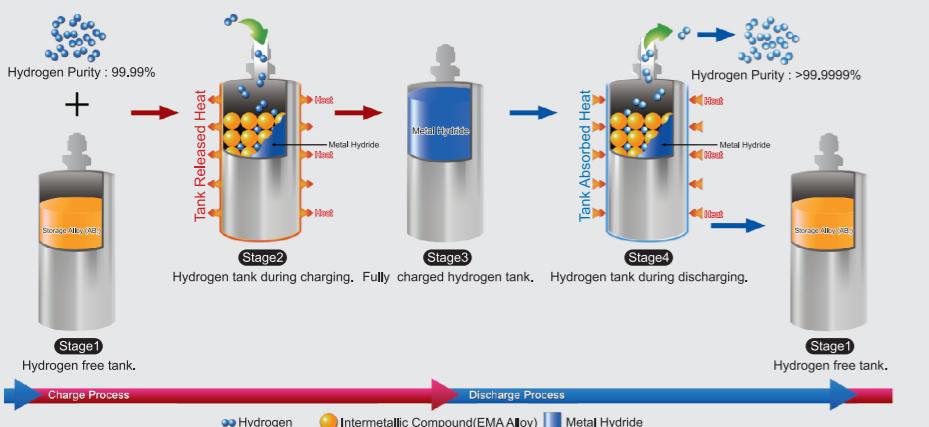
## Marketing objective:

Manufacturing low pressure, small size, high and stable flow rate, high purity, long life cycle metal hydride hydrogen storage systems, H Bank Technology Inc.'s main objective is to introduce metal hydride hydrogen storage as the ultimate hydrogen storage for fuel cell systems ranging from 1 to 25kW power. Considering the development of fuel cell technology and its ever increasing applications, H Bank Technology Inc. is willing to consult and cooperate with hydrogen power system builders, hydrogen infrastructure designers and/or other research organizations on integrating metal hydride storages with their systems, establishing ODM/OEM partnerships.

## Capability:

Starting with higher absorption rate, long life cycle, reversible AB<sub>5</sub> type alloy compositions, our metal hydride storage production process covers every step: from alloy prescription to storage shell design, from casing to system modulation. With internationally patented alloy composition, production method, and storage system structure, H Bank Technology Inc.'s production team is able to custom design metal hydride hydrogen storages according to any customer specified characteristics, including storage shape, size, hydrogen pressure, flow rate & etc. Our R&D team is fully experienced to plan and totally integrate safe, reliable, economical hydrogen storages with any hydrogen equipment.

## Metal Hydride charge/discharge scheme



# C ore technology

## Alloy:



Patents: 094108932 (Taiwan), ZL2005 1 0062992.1 (China)

Developed by H Bank Technology Inc. in 2000, our patented AB<sub>5</sub> type alloy compositions are able to absorb and release hydrogen as high as 1.65wt.%, whereas the maximum value for commercial AB<sub>5</sub> type alloys are below 1.5wt.%. The reversibility of our alloy is well above 3000 cycles with less than 10% decay in the original absorption capability. Moreover, charged with only 99.99% pure hydrogen, our storages automatically deliver 99.9999% pure hydrogen at no additional cost.

## Composition:

Patents: 158203, 196342 (Taiwan), ZL00129765.1 (China)

H Bank Technology Inc. is able to adjust AB<sub>5</sub> type alloy compositions to meet different operation conditions. Our standard metal hydride hydrogen storages are designed to operate at ambient room temperatures with low discharge pressure.

## Shell design



Patents: US 7,320,726 B2 (U.S.A), I 267605 (Taiwan), ZL2004 1 0094188.7 (China)

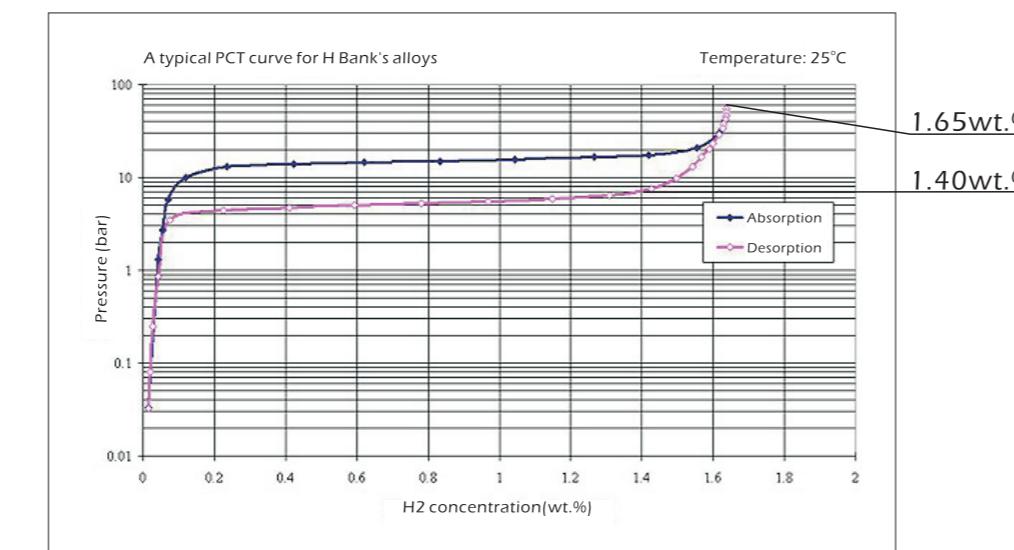
Complying with ISO regulations, all H Bank Technology Inc.'s metal hydride hydrogen storage shells are made of SS316L grade stainless steel. Assembled in vacuum environment with laser welded shell, our specially designed multi-layer internal structure, ultra-fine outlet filter system assembly guarantee no alloy powder detection during discharge, which fully avoids possible short-circuit in fuel cell systems. H Bank Technology Inc.'s patented hydrogen storage shell structure uniformly distributes alloy inside the shell, preventing possible powder subsiding process. This design enables better heat transfer and avoids irreversible shell deformation due to expansion of hydrogen absorbing material.

## Customization:

Patents: I 271487 (Taiwan), ZL2004 1 0012030.0 (China)

To better fit different application circumstances, H Bank Technology Inc. has developed and producing 10, 50, 100, 300, and 660 Std.Liter metal hydride hydrogen canisters, each with high and low pressure alloy selections. We assemble hydrogen storages above 660 Std.liters in modules to reach higher larger capacity and/or flow rates. Our production team is able to offer also custom design metal hydride storages with different shape, size, absorption/desorption characteristics with H Bank Technology Inc. guaranteed quality and full lifetime service.

## AB<sub>5</sub> type alloy PCT characteristics curve



# P roduct line for Fuel Cells(1W ~ 300kW) P erformance

## 10Liter

HB-SC-0010-Q

Applications:  
Designed specifically for mini size fuel cells or fuel cells in toys.

## 50Liter

HB-SC-0050-Q

Applications:  
For portable fuel cells  
For fuel cells in first aid equipments.

## 100Liter

HB-SC-0100-Q

Applications:  
For medium size fuel cells  
For fuel cells in medical instruments.

## 660Liter

HB-SC-0660-N

Applications:  
For stationary fuel cells  
For fuel cells in electric motorcycles or electric bicycles.

## 3300Liter

HB-SS-3300

Applications:  
For fuel cells in PC UPS.  
For fuel cells in FC hybrid or hydrogen vehicles.

## 16500Liter

HB-SS-16500

Applications:  
For back-up power supply system  
For fuel cells in yachts and sub-marines.

At H Bank Technology Inc., every day we devote our strength to replace dangerous high pressure hydrogen vessels with low pressure, portable, long-life, rechargeable metal hydride hydrogen storages. Comparison between the three basic storage options shows the potential advantages of storing hydrogen in solid state much better than gaseous and liquid hydrogen storage forms.

Storage type	Pressure (bar)	Gravimetric density (weight %)	Volumetric density (kg/m <sup>3</sup> )
High Pressure*	150	0.85	9.86
Cryogenic Liquid**	13	20.00	30.00
Metal Hydride***	10	1.00	43.61

\* Airproduct, No.1 high pressure steel tank, 140bar, 40L water capacity, 230<sup>o</sup>D mm x 1200<sup>l</sup> mm, 59kg

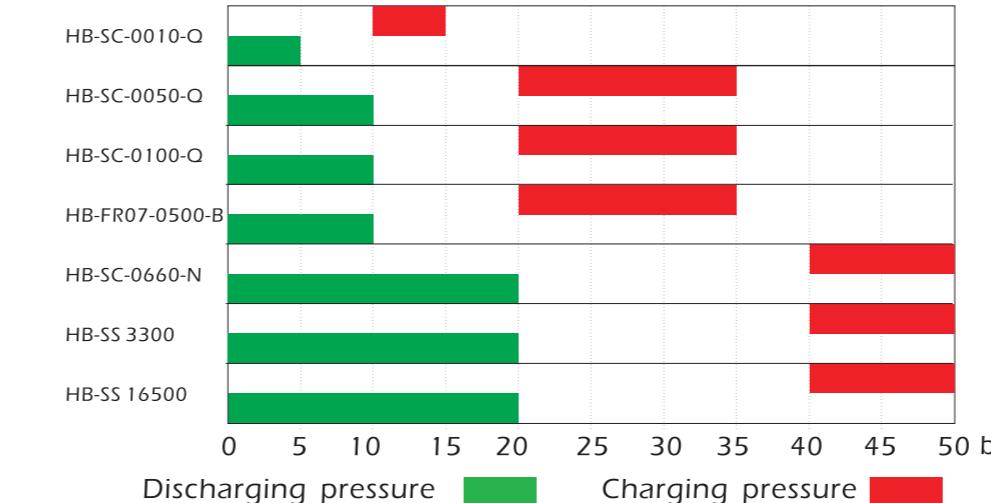
\*\* Trygve Riis, Gary Sandrock, Oystein Ulleberg, Preben J.S. Vie, Hydrogen Storage – Gaps and Priorities Riis et al.2005

\*\*\* H Bank Technology Inc. HB-SC-0660-N: 10bar, 660 Std.L hydrogen capacity, 75<sup>o</sup>D mm x 306<sup>l</sup> mm, 6kg

Compressed gas and cryogenic liquid storage are the most commercially viable options today, but the comparative advantages of metal hydride hydrogen storage systems are :

- Smaller size (highly portable)
- Lower pressure (safe and energy saving)
- Higher purity hydrogen output (economic)

## Hydrogen charging, discharging pressure



## Metal Hydride hydrogen storage buying tips

1. Guarantee of no alloy powder detection at discharge
2. Maximum stationary flow rate indicates upper limit of flow rate for full discharge of the storage capacity
  - Short time discharge flow rate can be much higher than stationary flow rate
3. Life cycle of alloy
  - Hydrogen absorption capability of metal hydride alloy decays along usage

Manufacturer	H Bank Technology Inc. *
H <sub>2</sub> capacity (Std.L)	10~660; Modulation above 660 Std.L
H <sub>2</sub> density in alloy (wt.%)	1.65
H <sub>2</sub> gravimetric density in storage (wt.%)	1.0
H <sub>2</sub> volumetric density in storage (kg/m <sup>3</sup> )	43.61
Alloy operation life cycle	<10% decay in original capacity after 3000 cycles
Shell Design	Laser welded SS316L stainless steel assembly
Filtering System	Ultra-fine outlet filtering system
Flow rate (Std.L/min)	Max. 2.0 (25°C air convection)
Service and Guarantee	Life-time service on all products; 1 year warranty

\*HB-SC-0660-N

## Hydrogen discharge flow rate

